

28 - 30 AUGUST, 2008

# THE SIXTH REGIONAL IMT-GT UNINET CONFERENCE 2008

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## PBD14

### Diversity Of *Fusarium* Species Associated With Ear Rot Of Corn In Indonesia And Malaysia

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#### INTRODUCTION

*Fusarium* ear rot is the most common fungal disease on corn ears and occurs world wide. It is caused by several species of *Fusarium*. *F. verticillioides*, formerly known as *F. moniliforme*, the teleomorph state of *Gibberella fujikuroi* are the most frequently occurring species. Some other species, such as *F. proliferatum*, and *F. graminearum* (*G. zea*) are much less frequent causing ear rots of corn. However, the latter species occurs frequently in Europe and America (Summerell *et al.*, 2003).

Symptoms of *Fusarium* ear rots are white to pink- or salmon-colored mold, beginning anywhere on the ear or scattered throughout. Often the decay begins with insect-damaged kernels. Usually it does not involve the whole ear. Infected kernels are often tan or brown, or have white streaks (McGee, 1988).

So far, the research on the corn ear rot diseases has been carried out intensively in the temperate countries but not in the tropical countries, including Indonesia and Malaysia. It has been reported that there are four species *Fusarium* (*F. graminearum*, *F. proliferatum*, *F. subglutinans* and *F. verticillioides*) cause ear rots on corn (McGee, 1988).

The climate is the important factor that influences the growth and spread of *Fusarium*. Usually, the number of *Fusarium* species in the tropical regions is higher than that in the temperate region and the disease implicated by this fungus is also more severe (Leslie and Summerell, 2005; Leslie *et al.*, 2003). Because of differences in geography and climate between the temperate and tropical regions, we studied the diversity of species *Fusarium* associated with ear rots of corn in Indonesia and Malaysia. To distinguish *Fusarium* species, morphological characteristics are the basic criteria used for identification (Leslie & Summerell, 2005; Burgess *et al.*, 1994).

#### MATERIALS AND METHODS

##### Corn samples

A total of 85 samples of visibly *Fusarium*-infected corn ears were collected at different localities in Indonesia and Malaysia (Tabel 1).

##### Isolation and Culture of *Fusarium* Sp.

Visibly *Fusarium*-infected corn kernels showing typical ear rot symptoms were surface sterilized in a 1% aqueous solution of sodium hypochlorite (NaOCl) for 1 min, rinsed with several changes of sterile water, placed on semi-selective medium, peptone pentachloronitrobenzene agar (PPA) and incubated at room temperature for 5 - 7 days. To obtain pure cultures, *Fusarium* isolates were single-spored on water agar (WA) plates by streaking a conidial suspension with a concentration equivalent to 1-10 conidia in a water film of a wire loop, viewed under a low power objective of a compound microscope. The plates were incubated at room temperature for 18 - 24 hr and examined by using a dissecting microscope. A single germinated conidium was removed on square agar by using a transfer needle onto a PDA plate (Booth, 1977; Burgess, *et al.*, 1994; Leslie, *et al.*, 2005).

##### Species Identification of *Fusarium* isolates

To observe the morphological characteristics, single-spore cultures of *Fusarium* spp. were grown on Carnation Leaf-piece Agar (CLA) for 6 – 10 days (Fisher *et al.*, 1982). However, to observe the pigmentations and the growth rates, the cultures were grown on PDA plates for 5 days (Burgess *et al.*, 1994; Leslie and Summerell, 2005). Then, *Fusarium* isolates were morphologically identified into species level.

## RESULTS AND DISCUSSION

A total of 85 isolates of *Fusarium* were obtained from corn ears showing typical corn ear rot symptoms from fields in Indonesia and Malaysia, and identified morphologically into 12 species i.e. *F. verticillioides* (21 isolates, 24.7%), *F. graminearum* (15 isolates, 17.6%), *F. proliferatum* (15 isolates, 17.6%), *F. semitectum* (15 isolates, 17.6%), *F. nygamai* (8 isolates, 9.4%), *F. solani* (4 isolates, 4.7%), *F. fujikuroi* (4 isolates, 4.7%), *F. oxysporum* (2 isolates, 2.3%), *F. pseudoanthophilum* (2 isolates, 2.3%), *F. sacchari* (1 isolate, 1.2%), *F. thapsinum* (1 isolate, 1.2%), and *F. chlamyosporum* (1 isolate, 1.2%) (Table 1). High numbers of *Fusarium* species were recovered, because the isolates were collected from infected corns in tropical region. According to Leslie *et al.* (2005), *Fusarium* in the tropics are quite diverse in terms of numbers of species, distribution, host range and virulence compared to those in the temperate region.

*F. verticillioides* was the dominant species recovered from corn ear rot collected, followed by *F. graminearum*, *F. proliferatum* and *F. semitectum*. Both *F. verticillioides* and *F. proliferatum* were well distributed. However *F. graminearum* only was recovered in Agam Regency, 800 m above sea level. It means, *F. graminearum* can grow well in low temperature regions. According to Leslie *et al.* (2005), *F. verticillioides* and *F. proliferatum* are the most frequently found on corn throughout the world whenever maize is cultivated. The statements are also confirmed by Silva *et al.* (2007) that *F. verticillioides* were found in five provinces in Ecuador, however, *F. graminearum* only was found in one province. *F. graminearum* (Miller, 2001) grows well only between 26 and 28°C and this temperature are almost similar to this in Agam Regency.

Only a few isolates of *F. fujikuroi*, *F. solani*, *F. thapsinum*, *F. sacchari* and *F. pseudoanthophilum*, *F. oxysporum*, and *F. chlamyosporum* were recovered. Although *F. fujikuroi*, *F. thapsinum*, *F. sacchari* and *F. pseudoanthophilum* have been reported on corn, they are not the primary pathogens. Also, *F. solani* and *F. oxysporum* are not the pathogens on corn, but on vegetables and other crops. *F. semitectum* and *F. chlamyosporum* are well-known saprophyte. However, to confirm that these *Fusarium* species are not pathogens, the pathogenicity test is being carried out in the greenhouse.

**Table 1.** The species and locality of *Fusarium* isolates

Field corn locations	No of samples	<i>Fusarium verticillioides</i>	<i>Fusarium graminearum</i>	<i>Fusarium proliferatum</i>	<i>Fusarium semitectum</i>	<i>Fusarium nygamai</i>	<i>Fusarium solani</i>	<i>Fusarium fujikuroi</i>	<i>Fusarium oxysporum</i>	<i>Fusarium pseudanthophilum</i>	<i>Fusarium sacchari</i>	<i>Fusarium thapsinum</i>	<i>Fusarium Clamydosporeum</i>
Aceh, Sumatra, Indonesia	5	-	-	2	3	-	-	-	-	-	-	-	-
Bukit Temiang, Perlis, Malaysia	2	1	-	-	-	-	-	-	1	-	-	-	-
Cebuag, Agam, West Sumatra, Indonesia	17	1	9	-	-	2	1	2	-	-	1	-	1
Kampung Cikgu Ah, Perlis, Malaysia	1	-	-	-	-	-	1	-	-	-	-	-	-
Kayu Bajak, Padang Pariaman, West Sumatra, Indonesia	3	-	-	-	-	-	2	-	-	1	-	-	-
Kelok Kuraji, Padang Pariaman, West Sumatra, Indonesia	5	2	-	-	-	2	-	-	-	1	-	-	-
Koto Tangah, Padang, West Sumatra, Indonesia	9	3	-	5	-	-	-	1	-	-	-	-	-
MARDI Bertam, Penang, Malaysia	2	-	-	1	-	1	-	-	-	-	-	-	-
Pasar Besar Kinabalu, Sabah, Malaysia	6	3	-	-	3	-	-	-	-	-	-	-	-
Panampuang Agam, West Sumatra, Indonesia	7	-	5	-	-	1	-	-	-	-	-	1	-
Ranau, Sabah, Malaysia	4	-	-	3	1	-	-	-	-	-	-	-	-
Sungai Buluh, Padang Pariaman, West Sumatra, Indonesia	3	1	-	-	1	1	-	-	-	-	-	-	-
Sungai Baringin, Agam, West Sumatra, Indonesia	2	-	1	-	-	-	-	1	-	-	-	-	-
Sungai Puar, Agam, West Sumatra, Indonesia	2	-	-	2	-	-	-	-	-	-	-	-	-
Sri Aman, Sarawak, Malaysia,	4	-	-	2	2	-	-	-	-	-	-	-	-
Talang Julo, Padang Pariaman West Sumatra, Indonesia	-	-	-	-	1	-	-	-	1	-	-	-	-
Tubung Agung, East Java, Indonesia	3	3	-	-	-	-	-	-	-	-	-	-	-
Yogyakarta, Central Java, Indonesia	7	7	-	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	85	21 24,7%	15 17,6%	15 17,6%	11 13,1%	8 9,4%	4 4,7%	4 4,7%	2 2,3%	2 2,3%	1 1,2%	1 1,2%	1 1,2%

**CONCLUSIONS**

Eighty five isolates of *Fusarium* obtained from corn with ear rot symptoms collected from fields in Indonesia and Malaysia were identified morphologically into 12 species i.e. *F.*

*verticillioides* (21 isolates, 24.7%), *F. graminearum* (15 isolates, 17.6%), *F. proliferatum* (15 isolates, 17.6%), *F. semitectum* (15 isolates, 17.6%), *F. nygamai* (8 isolates, 9.4%), *F. solani* (4 isolates, 4.7%), *F. fujikuroi* (4 isolates, 4.7%), *F. oxysporum* (2 isolates, 2.3%), *F. pseudoanthophilum* (2 isolates, 2.3%), *F. sacchari* (1 isolate, 1.2%), *F. thapsinum* (1 isolate, 1.2%), and *F. chlamysporum* (1 isolate, 1.2%). *F. verticillioides* and *F. proliferatum* were well distributed. However, *F. graminearum* only was found in cooler climate i.e. Agam Regency, Indonesia. Some of the species i.e. *F. semitectum*, *F. clamydosporum*, *F. solani* and *F. oxysporum* have never been reported from corn ear rots both in Indonesia and Malaysia.

#### ACKNOWLEDGEMENT

We thank Mr. Mohd Kamaruddin Mohd Maidin for technical assistance. The expenses were supported by RU Grants No. 1001/PBIOLOGI/811009

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